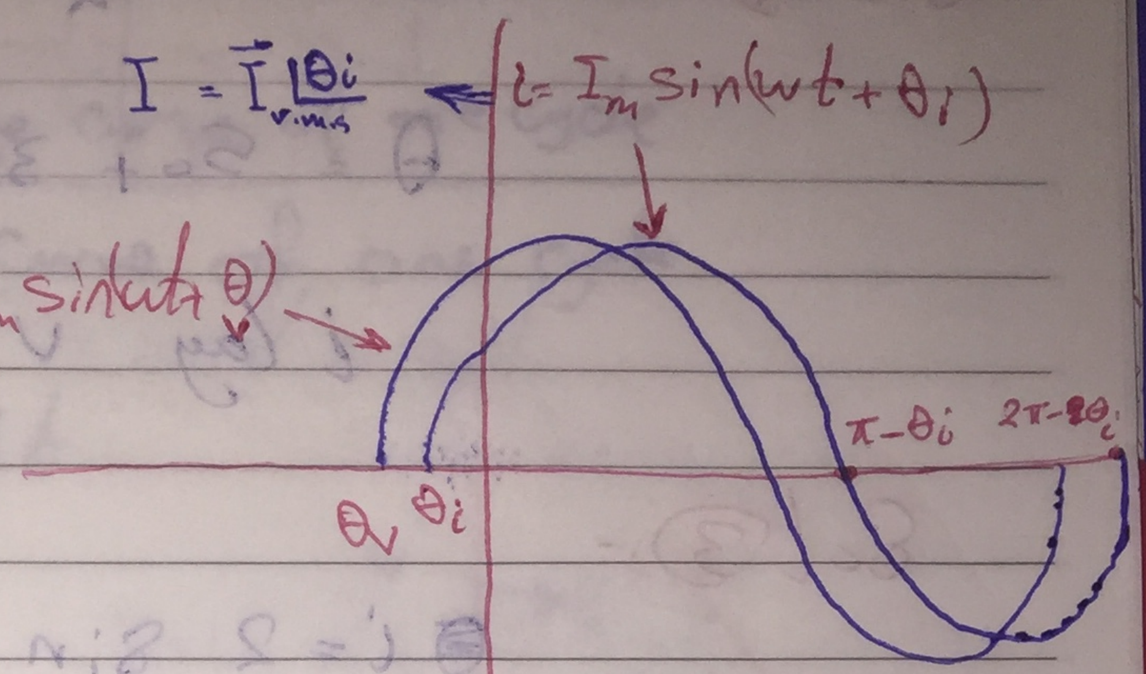
Subject. Date.

* phase shift:

$I = \vec{I}_{\text{r.m.s}} \angle\theta_i$ ⇐ $i = I_m \sin(\omega t + \theta_i)$

phasor form

$V = \vec{V}_{\text{r.m.s}} = V \angle\theta_v$ ⇐ $v = V_m \sin(\omega t + \theta)$



* $\theta \equiv \theta_v - \theta_i$

(الزاوية بين i, v)

θ angle

find phase shift

① $v = 100 \sin(\omega t + 40)$, $i = 10 \sin(\omega t + 90)$

② $v = 15 \sin(\omega t + 50)$, $i = 1 \sin(\omega t - 30)$

③ $v = 30 \sin(\omega t - 10)$, $i = 2 \cos(\omega t + 30)$

④ $v = 20 \sin(\omega t + 10)$, $i = -5 \sin(\omega t + 30)$

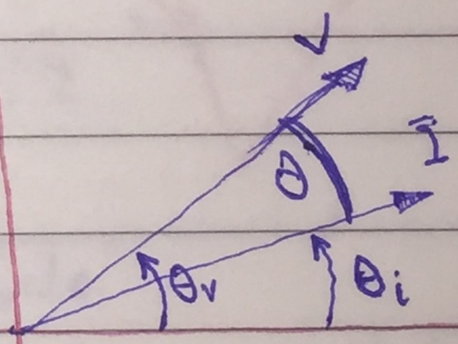
⑤ $v = 30 \sin(\omega t - 180)$, $i = -5 \cos(\omega t - 30)$

v lead i by θ
or
i lag v by θ

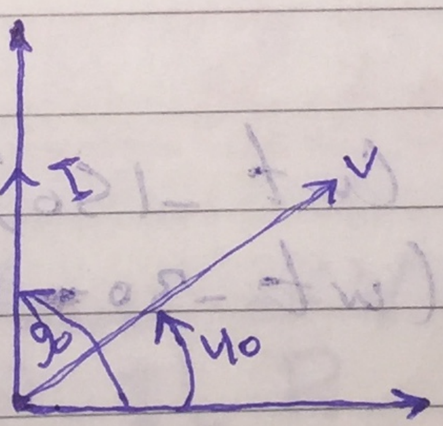
---

sol ②: $\theta_v = 40$, $\theta_i = 90$

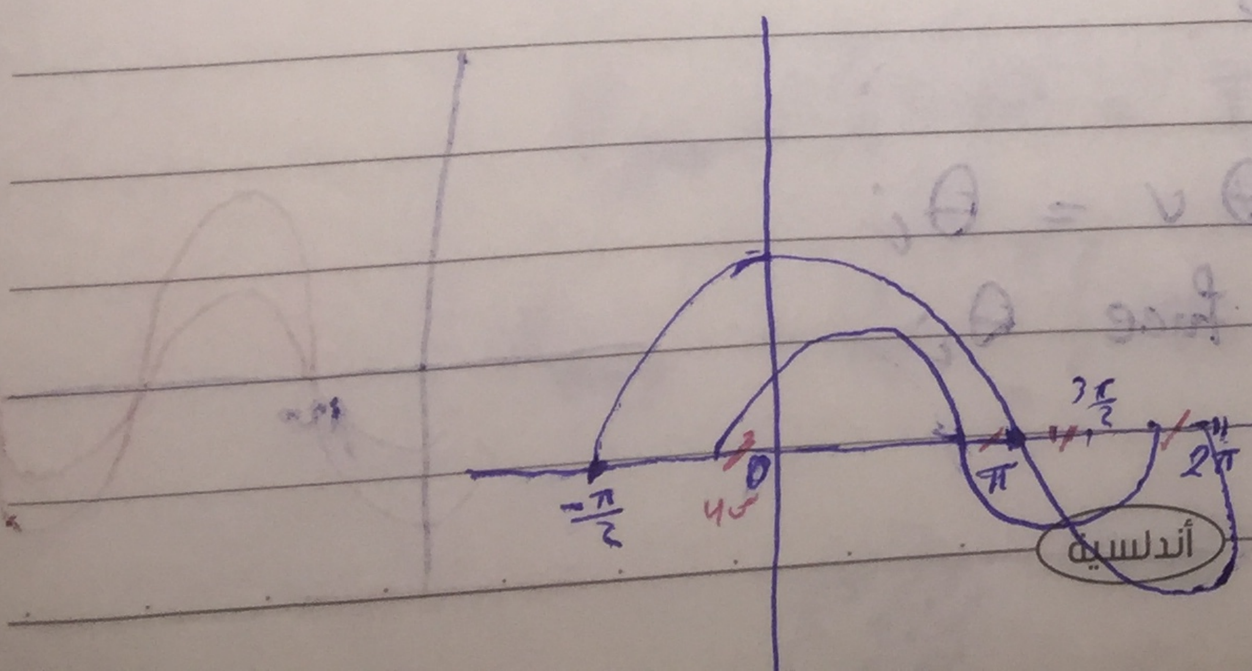
$\theta = \theta_v - \theta_i = 40 - 90 = -50$



I lead V by 50°



لازم يرسم بـ scale
لو كان مش معلوم
"Phasor Digraph"



$\cos\omega t = \sin(\omega t + 90)$

$\sin\omega t = \cos(\omega t - 90)$

$\sin(-\theta) = -\sin\theta$

$\cos(-\theta) = \cos\theta$

$-\sin\theta = \sin(\theta \pm 180)$

$-\cos\theta = \cos(\theta \pm 180)$

Subject.

Date.

Sol ②:- $\theta_v = 5^\circ$ & $\theta_i = -3^\circ$

$\theta = 5^\circ + 3^\circ = 8^\circ$

i lag v by 8°

Sol ③:-

$i = 2 \sin(\omega t + 90 + 10)$

$\theta_v = -10$

$\theta_i = 100$

$\theta = -110$

i lead v by 110

Sol ④:- اى تديتنا زاوية صغيرة

$i = \sin(\omega t + 30 - 180)$

$\theta_v = 10$, $\theta_i = -150$

$\theta = -160$

V lead i 160°

Sol ⑤:-

$V = 30 \sin(\omega t - 150)$

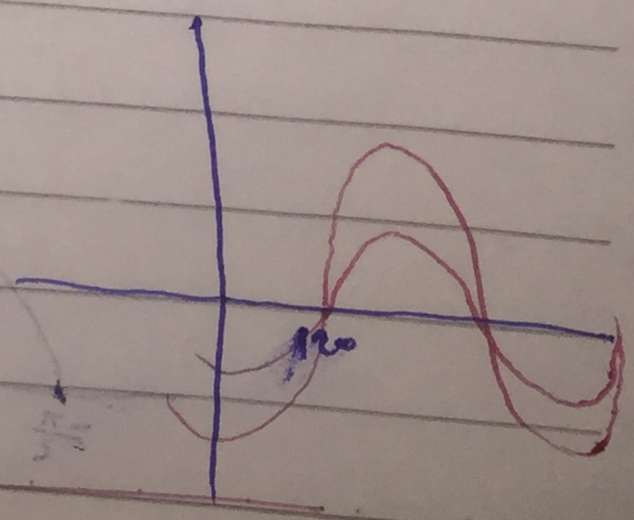
$i = 5 \cos(\omega t - 30 - 180 + 90)$

$\theta_v = -120$

$\theta_i = -180$

$\therefore \theta_v = \theta_i$

$\therefore \theta_v$ face θ_i



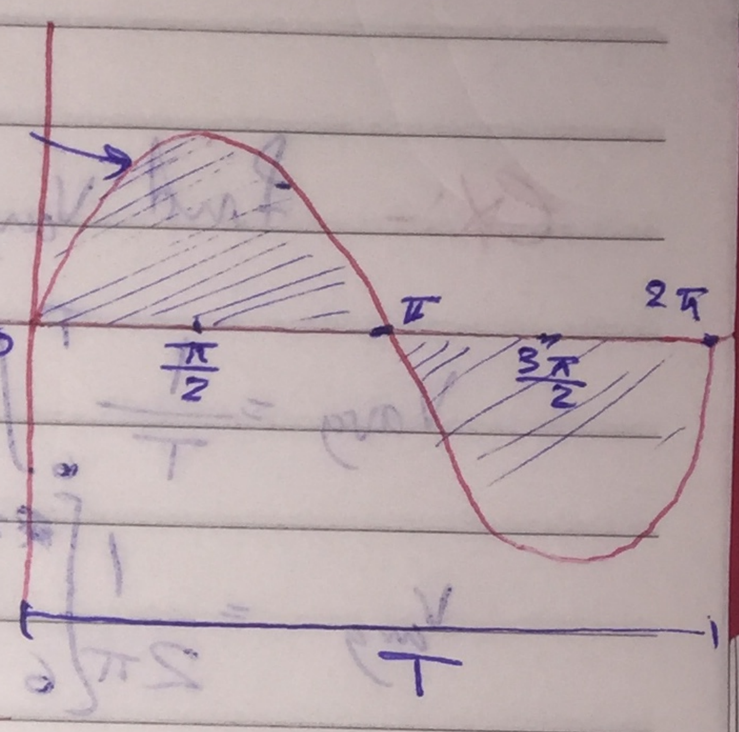
Subject. Date.

* Average value or Mean value :-

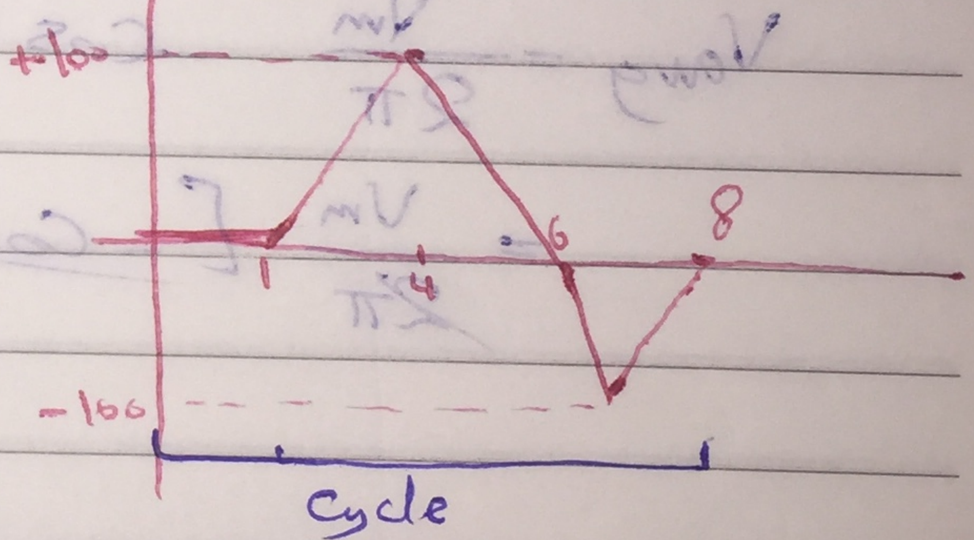
$$V_{AVg} = \frac{\sum \text{area under the curve of one cycle}}{\text{Length of curve of one cycle}}$$

$$V_{avg} = \frac{1}{T}\int_0^T v(t)\,dt$$

$$= \frac{1}{2\pi}\int_0^{2\pi} V_m \sin \omega t \, d\omega t$$



ex: find the V_{avg}:



$$V_{avg} = \frac{\frac{5}{2} \times 100 - \frac{2}{3} \times 100}{7}$$

* Effective value or Root mean Square value:

V_{eff} or $V_{r.m.s}$ or V

$I_{dc} \Longrightarrow P = I_{dc}^2 R$

$$P_{(t)} = i^2 R = I_m^2 \sin^2(\omega t) \cdot R$$

$$P_{avg} = \frac{1}{T}\int_0^T P(t)\,dt = \frac{1}{T}\int_0^T I_{dc}^2 R\,dt$$

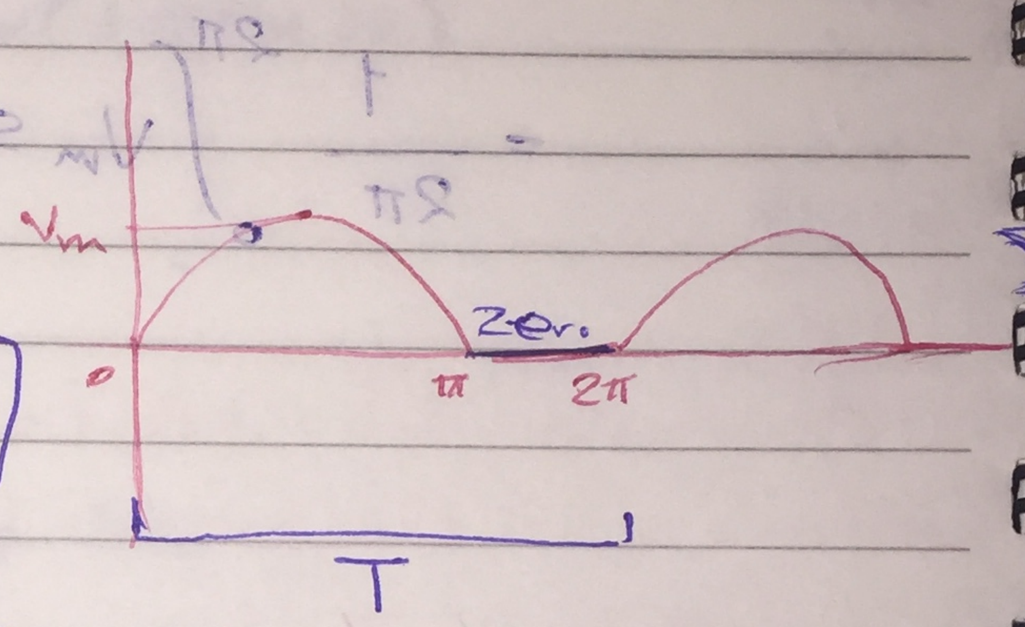
Subject.

Date.

$$I_{eff} = \sqrt{\frac{1}{T}\int_0^T i^2(t)\,dt}$$

$$V_{eff} = V_{r.m.s} = V = \sqrt{\frac{1}{T}\int_0^T v^2(t)\,dt}$$

Ex:- find V_{avg} & V_{eff}



$$V_{avg} = \frac{1}{T}\int_0^T v(t)\,dt$$

$$V_{avg} = \frac{1}{2\pi}\int_0^{\pi} V_m \sin \omega t\, d\omega t$$

$$V_{avg} = \frac{V_m}{2\pi}\left[-\cos \omega t\right]_0^{\pi}$$

$$= \frac{V_m}{2\pi}\left[-\cos\pi + \cos 0\right] = \frac{V_m}{\pi}$$

$$V_{eff} = \sqrt{\frac{1}{2\pi}\int_0^{\pi} V_m^2 \sin^2(\omega t)\,d\omega t}$$

$$= \sqrt{\frac{V_m^2}{2\pi}\int_0^{\pi} \sin^2(\omega t)}$$

$$= \sqrt{\frac{V_{m2}}{2\pi}\int_0^{\pi}\left(\frac{1}{2} - \cos 2\omega t\right) d\omega t}$$

Subject. Date. $\frac{V_m}{\sqrt{2}}$

Report: Sin wave find V_{eff} V_{avg}
(2016)